

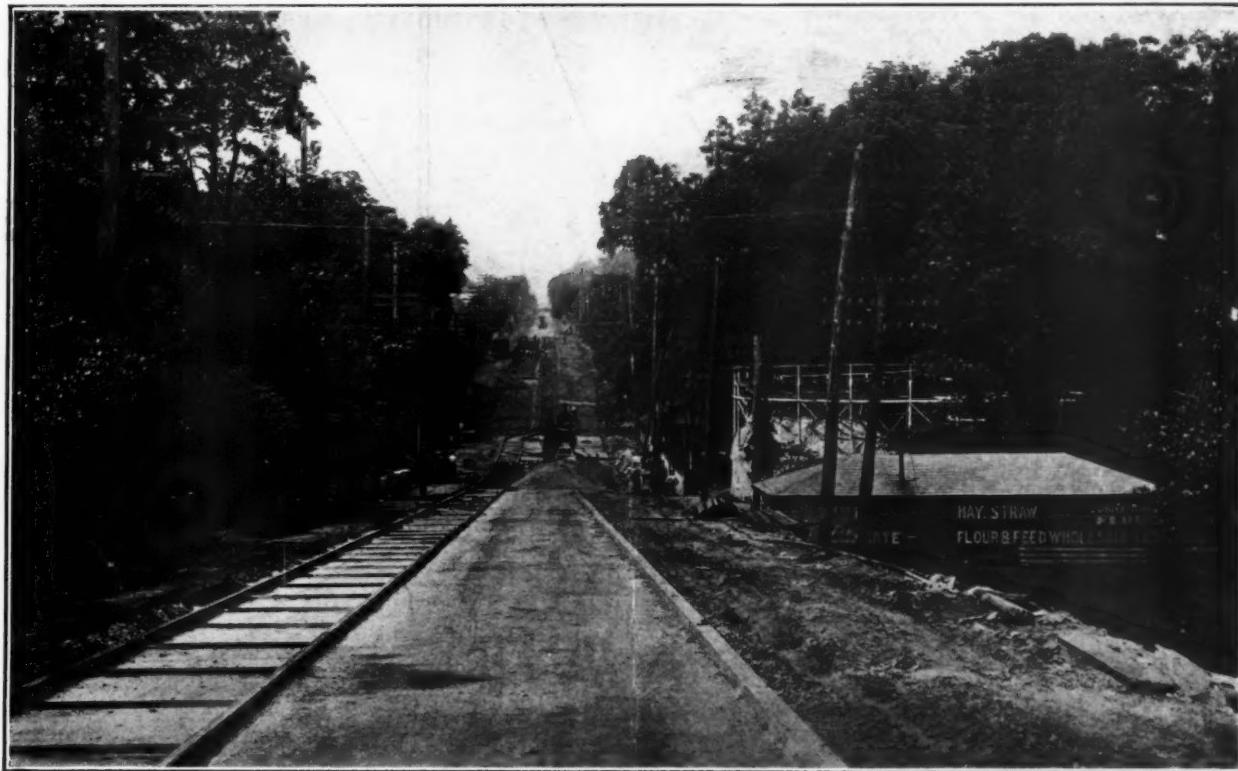
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RECONSTRUCTION OF THE PHILADELPHIA PIKE, DELAWARE

In the foreground, concrete base ready for 18-foot brick pavement. Beyond the mixer, a steam roller is compacting ballast for a 40-foot section of pavement.

This work will be described next week.

IN THIS ISSUE

Constructing Ralph Avenue Sewer, Brooklyn
The Wanaque Dam
Why Good Contractors Sometimes Fail to Bid

Width and Thickness of Illinois Highway Pavements
Wood Preserving Notes by Forest Products Laboratory
Reports and Records of Delaware Highways

DECEMBER 4, 1920

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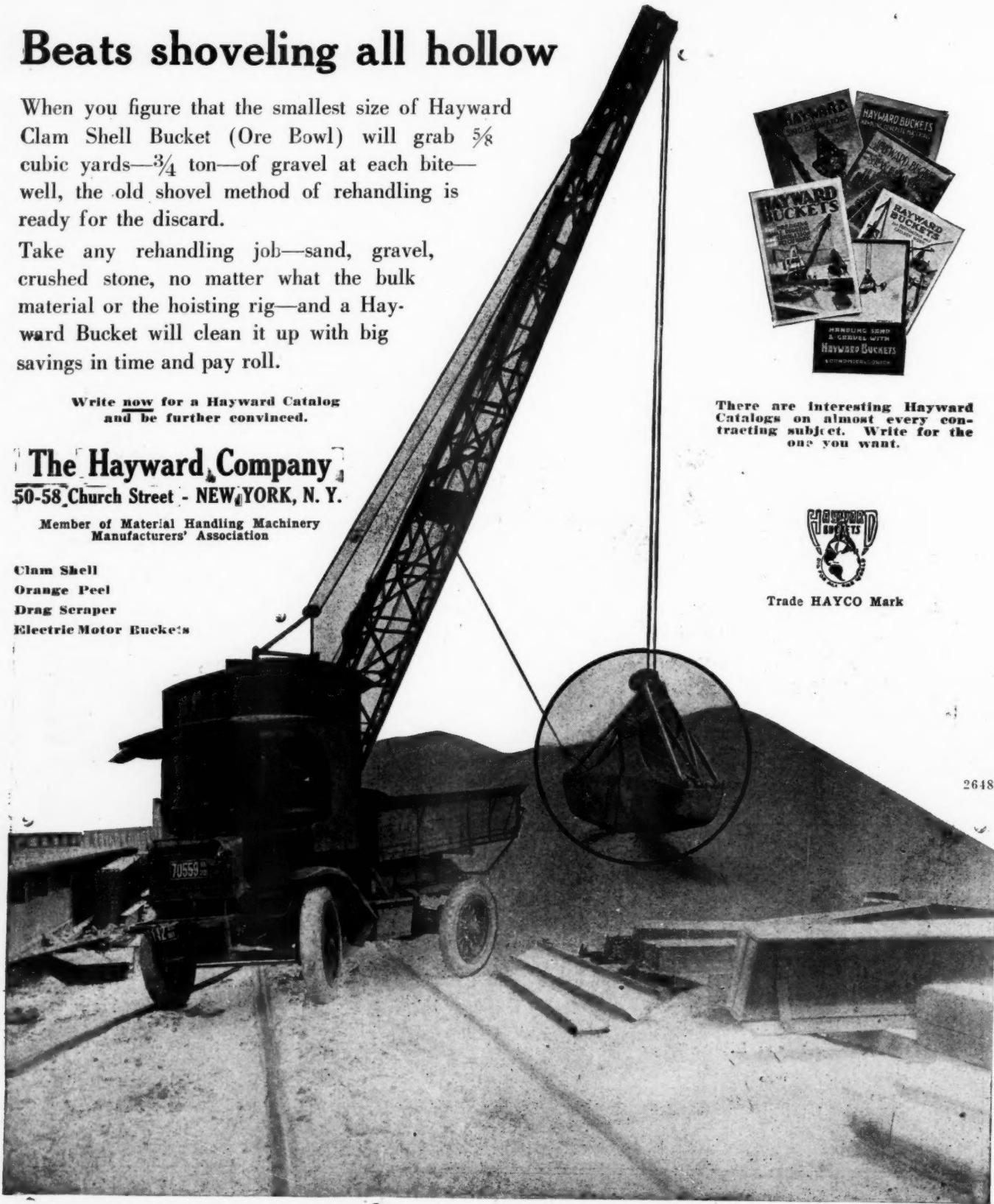
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Entered as Second-Class matter at the Post Office at Floral Park, N. Y., August 27, 1920, under the Act of March 3, 1879.

Vol. 49

FLORAL PARK, DECEMBER 4, 1920

No. 23

Ralph Avenue Sewer, Brooklyn

Very large concrete twin storm-water sewer, pump house, sanitary sewer and outlet chamber built in sand below water level. Ample plant installed and careful sequence of operations secured continuous rapid construction. Large amount of ground water handled without difficulty.

The Ralph avenue sewer, from Remsen avenue to Flatlands avenue, Brooklyn, N. Y., is about 8,350 feet long and its construction, together with that of the pump house, a large outlet chamber, discharge channel to Jamaica bay, sanitary sewer, and various connections and appurtenances, were included in three construction contracts awarded to the J. F. Cogan Company in 1917, and are now approaching completion under the direction of the Bureau of Sewers, Borough of Brooklyn, Arthur J. Griffin, chief engineer.

The principal estimated items of one contract, designated as the middle contract, include 1,635 linear feet of 168-inch storm sewer, 425 feet of 156-inch storm sewer, 2,605 feet of 138-inch storm sewer, 438 feet of 72-inch sanitary sewer, 3,192 feet of 54-inch sanitary sewer, 800,000 linear feet of foundation piling, 200,000 feet of sheeting and bracing, and 300,000 pounds of reinforcement steel. The contract price was \$700,238.84, and the time was limited to 400 days, an amount which has been considerably extended on account of delays for which the contractor was not responsible.

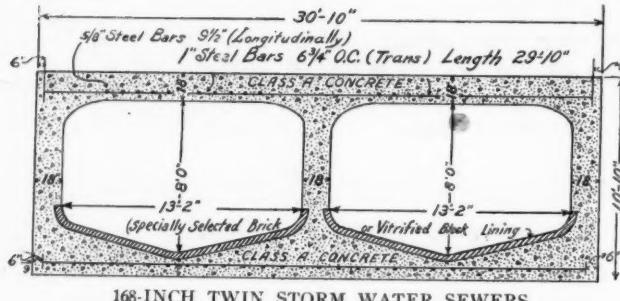
Outlet work in Flatlands avenue, including the sub-structure of the pumping station, was let on a separate contract called the third contract, for \$432,365. The principal items included in it are

262 linear feet of combined 186-inch, 168-inch and 90-inch storm sewer, 209 feet of 186-inch, 56 feet of 168-inch, 39 feet of 90-inch and 235 feet of 72-inch storm sewer, 156 feet of 54-inch and 156 feet of 48-inch sanitary sewer, 275,000 feet of foundation planking and pile caps, 30,000 feet of piles, 90,000 pounds of steel reinforcement bars, and 60,000 yards of dredging, besides the two connecting chambers, outlet chambers, sub-structure and appurtenances.



STEAM SHOVEL EXCAVATING UPPER PART OF SEWER TRENCH AND DELIVERING SPOIL TO HIGH LEVEL DUMP CAR

At this point the broken stone was stored in large piles on the surface of the ground and the cement was chuted through a hole in the roof of the cement storage house adjacent to the concrete mixing plant. Abundance of clean, sharp sand from the sewer trench excavation was hauled to a storage pile adjacent to the stone storage and was delivered thence by a bucket elevator to the elevated storage bin. The stone was delivered by a



168-INCH TWIN STORM WATER SEWERS

clam-shell bucket operated by a derrick boom to an elevated bin from which, like the sand, it was delivered by gravity to the charging hopper of an elevated 1-yard "Municipal" concrete mixer supplied with cement hoisted to the mixing platform by a barrel elevator.

EXCAVATING AND TIMBERING TRENCH

The twin 168-inch storm sewers are practically one structure divided by an 18-inch longitudinal partition wall and have flat V-shape brick-paved invert, flat reinforced roof, and 18-inch vertical side walls. Their combined cross section is a rectangle 30 feet 10 inches wide and 10 feet 10 inches high. It was originally designed to build them on a 4-inch plank platform supported on foundation piles, but these were subsequently omitted.



MOVABLE PUMP PLANT DRAINING SANITARY SEWER TRENCH



SECOND POSITION OF TREASLE FOR CONCRETE SERVICE TRACK INSTALLED ON FINISHED INVERT

The storm sewer in the first contract, and part of that in the middle contract, were built in an open trench about 34 feet wide and with an average depth of about 20 feet below the surface of the ground and 15 feet below ground-water level. As the location is near marshy land on the shores of Jamaica bay and as the soil is coarse, loose sand, a very large amount of ground water was encountered and required expensive and continual heavy pumping, although the operations were so conducted that no delays or serious difficulties were experienced from this source.

In construction the three contracts were handled as one, with the same equipment and with operations arranged for the continuity and efficiency of the work.

The trench was excavated in both directions commencing at the middle of the work, near its intersection with the railroad. The upper part of the excavation, down to sub-grade of the storm sewers, was made with a 1-yard Bucyrus steam shovel, mounted on traction wheels and operating in the bottom of the trench. Where necessary, wooden panels were laid on the sand to prevent the settlement of the shovel and were moved forward by the dipper as the shovel advanced. The sides of the upper part of the trench were sloped to the natural angle but the lower part was sheeted with 2-inch vertical planks 8 feet long, driven about 2 feet below the trench bottom.

The shovel delivered to 3-yard narrow-gauge side-dump cars hauled in two or three-car trains by two gasoline locomotives on a service track on the surface of the ground. Operations were arranged as much as possible for these cars to dump directly into the trench over the finished sewer to provide the back fill without rehandling; but when this was impossible, the cars were hauled to a spoil bank and dumped there.

At the upper end of the sewer in the middle contract, the structure consisted of the twin storm sewers only, but at a point near the location of the concrete plant a line of 54-inch sanitary sewer was constructed adjacent to the storm sewer in a trench excavated at the bottom of the steam shovel trench and sheeted on both sides with wooden sheet piles. This excavation was

made with a 1-yard clam-shell bucket operated by the 50-foot boom of a traveling derrick installed on a 15-foot gauge track laid on the surface of the ground coincident with or parallel to the axis of the sewer, the derrick retreating as the excavation was made, and delivering the spoil directly to dump-cars.

The sides of the sanitary sewer trench were sheeted with 2x10-inch wooden sheet piles with the lower ends adzed to a knife edge. The sheeting and its transverse braces were set as fast as the excavation was made, the clam-shell bucket being carefully handled in the spaces between braces. The sheet piles were driven a few inches at a

DECEMBER 4, 1920

P U B L I C W O R K S

529

time by a McKiernan-Terry hammer operated by air from a gasoline engine-driven compressor mounted on wheels and moved along on the surface of the ground as the work advanced. The driving was facilitated by the use of an hydraulic jet in dry ground, and in wet ground by a jet of compressed air which gave equally good results in such ground and was found very convenient.

Heavy pumping was required to keep the water down in the sanitary sewer trench, where the bottom was dressed carefully to sub-grade. Piles were omitted, but the entire bottom was covered with two courses of 2-inch longitudinal planks. Notwithstanding that the sand was firm enough to support the sewer without additional foundation, the planks were used to make a floor for the drainage channel and to prevent undercutting by the flowing water.

CONCRETING

Concrete was delivered in special steel side-dump cars, spouted into the sanitary sewer trench, and filled the whole width of it except a 16-inch space left open along the sheeting on the side away from the storm sewer to provide a

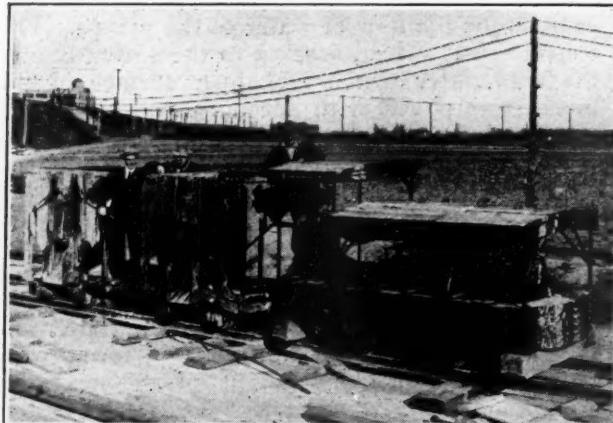
channel for the flow of water to the pumps. The concrete was placed first up to the spring-line of the arch, after which the upper surface of the invert was paved with specially selected bricks and the inner and outer forms were set for the concrete arch, which was formed in the same way as the invert and side walls, filling the trench completely except for the drainage channel up to an elevation 12 inches above the spring line, where the vertical outside faces of the side walls intersected the curved extrados of the arch. The sewer was built in 40-foot sections and after the concrete was 48 hours old, the arch forms were collapsed and moved forward for the next section, and so on.

The construction of this low-level sanitary sewer was really the key to the construction of the storm sewers and was pushed forward as rapidly as possible after the storm sewer trench had been excavated to the necessary depth. This sewer contained about $\frac{1}{2}$ yard of concrete to the linear foot, and was built at a maximum rate of 120 feet per week.

In building this sewer, care was taken to leave a clear space of 16 inches between the outer sidewall and the sheet piling, thus providing an open



BUILDING 72-INCH SANITARY SEWER IN LOW LEVEL TRENCH DRAINED BY TWO ELECTRIC PUMPS CONNECTED TO DISCHARGE PIPES ON THE LEFT. HANDLING SAND WITH MOVABLE DERRICK



SIDE DUMP CONCRETE CARS HAULED BY GASOLINE LOCOMOTIVE

channel with the bottom at about sub-grade of the invert, for the flow of the ground water which entered freely through the cracks between the sheet piles. Spaces were intentionally left between the adjacent edges of all the sheet piles on both sides of the trench to permit the unobstructed flow and seepage of the ground water, which was collected in the side channel.

This provided for the thorough drainage of the sand and prevented the collection of water outside the sheeting which would have developed a hydrostatic head that might have caused boiling and upheaval in the bottom of the trench, difficulties that were obviated by this method, which, with ample pumping facilities, not only kept the water down in the trench but gradually drained the adjacent soil so that the upper surface of the ground-water table sloped steeply away from the trench and no difficulty whatever was encountered in keeping the bottom of the trench dry and hard and in holding up the vertical faces adjacent to the sheet piling.

Generally only about 250 feet of the sanitary sewer trench was kept open at each end of the contract and the space was definitely limited every 40 feet by pairs of transverse braced wooden bulkheads 30 inches apart, retaining both the backfill and the face of the earth where the excavation was in progress. The 30-inch spaces between the bulkheads were excavated 30 inches below grade, making sumps in which about a yard of broken stone was deposited, forming a strainer that allowed the considerable flow of ground water collecting around the finished portions of the sewer to pass through to the pump without washing away the backfill.

168-INCH SEWER

After the main trench had been excavated to sub-grade and the low level sanitary sewer built, transverse timber sills were placed on the main sub-grade, and on them framed trestle bents were erected and braced together to form a falsework carrying a service track for the concrete cars that were set to dump on either side into chutes delivering the concrete wherever required.

Transverse wooden frames or ribs with a horizontal upper strip and a lower strip shaped to correspond with the soffit of the invert were set

about 6 feet apart longitudinally at the proper elevation. The invert reinforcement rods were usually omitted in the middle and upper sewer contract sections. Panels of wooden lagging were then set under the ribs and nailed to them and the space under them was concreted in 20-foot lengths, core boxes being placed around the lower ends of the trestle posts so as to leave cavities from which they could later be withdrawn. The end of each section of the invert forms was bulkheaded and core boxes attached to the bulkheads to form recesses for bonding with the next section of concrete.

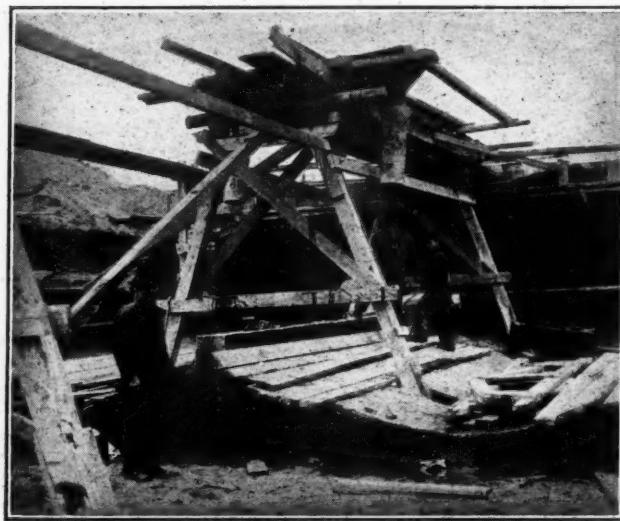
After the invert concrete was 48 hours old, the ribs and lagging were removed and collapsible steel Blaw forms for the side walls and roof slabs were set on the invert concrete, the trestle bents having been removed and the holes left by them in the invert having been filled with concrete.

Reinforcement bars for the sewer roof were laid on the tops of the forms, supported by concrete chairs manufactured at the site by the contractor, and the service track was laid over the top of the forms and extended beyond them on trestle bents replaced on the finished invert so that the cars could deliver concrete both to the roof slab and to the invert in advance.

The roof and side walls were concreted in the same operation, and under favorable conditions with an average total working force of 100 men, the sewer was completed at the rate of about 20 feet per day at each end. The excavating and concreting processes were duplicated and independent at the opposite ends, although both were served from concrete mixed at the central plant.

PUMPING

The trench was drained by four 6-inch, one 8-inch and one 10-inch Lawrence electrically driven centrifugal pumps, most of which were operated continuously day and night. These pumps were installed on movable platforms mounted on special tracks, picked up in the rear and laid down in advance on the bottom of the trench and on the



TRESTLE POSTS FOR CONSTRUCTION TRACK PASSING THROUGH TEMPORARY HOLES IN INVERT

sloping sides, so that they could be shifted every few days as the work advanced. The pumps delivered through vertical pipes and short lengths of horizontal steel pipes a short distance above the surface of the ground, which projected beyond the trench and discharged into open wooden flumes that were shifted with them and conducted the water to the nearest gutter or waterway, sometimes at considerable distance and sometimes involving purchase of the right of way for digging the ditch.

After the concrete walls and roof slabs of the storm sewer was 48 hours old, the forms were stripped and advanced, the steel forms being carried forward on collapsible steel towers of the Blaw pattern on trucks mounting on invert tracks. The sheet piles were left permanently in the ground, but the rangers and braces were removed as the concrete was placed, and were used over and over again. The trench was backfilled, the street regraded, and the excess spoil hauled away and wasted, although it was excellent building sand that could have been sold profitably but for the lack of building operations in the vicinity.

PUMP HOUSE

The excavation for the pump house was made by the steam shovel, down to elevation—10, beyond which it was completed with clam-shell buckets operated by the 50-foot booms of two stiff-leg derricks with electrically driven hoisting engines that were installed so as to command the entire site. The pit was drained by the electric pumps and the concrete from the central mixing plant was hauled to place on the service track extended over the surface of the adjacent ground and chuted to position.

The walls were built in 6-foot courses in wooden forms made with panels that were not wholly removed but were unbolted and lifted by the derrick booms for the successive courses while the lower edges of the panels still remained in contact with the faces of the walls that kept them aligned and spaced. The service track was eventually shifted and elevated on a central trestle that passed across the building to give it sufficient height for delivering the concrete by gravity to the upper parts of the walls.

The principal equipment installed on the job included six centrifugal pumps, one steam shovel, two clam-shell excavating buckets, two traveling and three fixed derricks, three Plymouth gasoline locomotives for hauling the concrete cars and the spoil cars, ten Steubner steel side-dump concrete cars of 45 cubic feet capacity, ten 4-yard side-dump wooden cars, one Chicago pneumatic air compressor, two McKiernan-Terry pile driving hammers, one 1-yard "Municipal" concrete mixer and two smaller concrete mixers, 200 linear feet of Blaw-Knox steel collapsible forms, a bucket elevator at the concrete plant for filling the stone and sand bins, and the usual equipment of hand tools.

With the exception of the steam shovel and locomotives, almost all of the plant installed on this job was operated by electricity, thus effecting a large economy of time and fuel.

The construction of both storm water and sanitary sewers in the same trench, with the sanitary sewer excavation and special drainage channel always maintained in advance, was an important feature of the work that both simplified and expedited it and effected an important reduction in the amount of pumping and bracing required in the previously saturated soil. By this method a dry trench was maintained, the bearing strength of the trench bottom was increased, and stability was developed for the sides of the trench.

The total contract price for the three contracts, based on estimated quantities and unit prices, was \$1,360,133.59. The principal items for the 8,350 feet of construction on Ralph avenue, between Remsen avenue and Flatlands avenue, include : 262 feet of 186-inch, 168-inch and 90-inch combined storm sewers, 209 feet of 186-inch storm sewer, 1,691 feet of 168-inch storm sewer, 425 feet of 156-inch storm sewer, 2,605 feet of 138-inch storm sewer, 2,018 feet of 132-inch storm sewer, 675 feet of 126-inch combined sewer, 433 feet of 114-inch combined sewer, 39 feet of 90-inch storm sewer, 673 feet of 72-inch sanitary sewer, 3,348 feet of 54-inch sanitary sewer, 156 feet of 48-inch sanitary sewer, 38 feet of 30-inch sanitary sewer, 42 feet of 10-inch sanitary sewer, 60 feet of 8-inch sanitary sewer, 910 feet of flood pipes, 54 manholes, 17 sewer basins, 1 float chamber, 1 connecting chamber A, 1 connecting chamber B, 1 outlet, the sub-structure for pumping station, 1,325,000 feet B. M. foundation planking, 370,000 feet B. M. sheeting and bracing, 133,000 linear feet piles, 365,000 pounds steel bars and 60,000 cubic yards dredging.

Amphibious Steam Shovels

In the construction of 6 miles of the Inland Empire Highway along the banks of the Yakima river, Washington, the contractors, Boss & Hampshire, excavated 180,000 cubic yards of loose volcanic rock and solid lava with two 18-B $\frac{3}{8}$ -yard Bucyrus revolving shovels mounted on caterpillar traction.

The shovels were shipped by rail to the bank of the river at a point where it is about 300 feet wide and 4 feet in maximum depth, with a gentle current and a bottom consisting of round boulders of all sizes. Steam was got up in the boilers and the shovels crossed under their own power in from 10 to 20 minutes each notwithstanding that some time was lost in removing large boulders and filling holes by the shovel itself. One of the shovels crossed in November and the other about a month later, when considerable ice was running.

Blasting With Quicklime

The National Lime Association describes as follows a very simple, safe and cheap method of wrecking and shattering rocks, foundations, etc., by utilizing the tremendous expansion force developed by slaking quicklime.

"To break up an old stone wall or other masonry, or to knock out a superfluous brick pier without the use of dynamite, slow hand labor is unnecessary. Simply drill a good-sized hole in the wall—making this bottle shaped with as small an opening as possible. Put in quicklime until this hole is almost full and make a tight-fitting wooden plug that can be driven firmly into the opening. Quickly pour in enough water to slake the lime and drive home the plug.

"The expansion of the lime as it slakes will exert a tremendous pressure that will easily break up any ordinary piece of masonry."

Width and Thickness of Illinois Highway Pavements

Evolution of specifications and reasons for increasing thickness discussed by the Division of Highways.

In a bulletin dated October 28, 1920, the Illinois Division of Highways gives the following brief statement concerning the development of pavement widths and thicknesses in that state:

The evolution in highway specifications is, in view of the present traffic situation, an interesting study. In 1913 our plans called for a concrete road 6 inches thick laid on a crowned subgrade. Beginning with 1915 we built a flat subgrade making the pavement 7 inches thick in the center and 6 inches on the side. Conditions brought about by the war forced a heavy truck traffic, especially in the east, and demonstrated the fact that our roads would be called upon to carry a much heavier burden than anticipated. Accordingly, our Federal Aid plans for 1919 called for pavements 7 inches in thickness at the side and 8 inches in the center. We realized later that on our double-track pavements traffic was practically as great on the side of the road as in the center. We therefore decided upon another change and are now building all concrete pavements 8 inches thick throughout their entire width; or where other types are used, what we consider to be the equivalent of an 8-inch concrete pavement.

The evolution in widths has been much the same. In the beginning of state road construction, a 10-foot road was considered sufficient on all roads except those adjacent to large centers of population, like Chicago. Now we are building all roads on the Federal Aid System 16 and 18 feet wide. In the future 18 feet will undoubtedly prevail—all of this because of the greatly increased traffic, as evidenced by the greatly increased registration of motor cars and trucks.

During the last session of the Legislature a

law was passed limiting loads of motor trucks to 8 tons per axle, including weight of the truck itself. In view of the fact that in most trucks about two-thirds of the weight is on the rear axle this law is generally equivalent to limiting the total load to 12 tons, including truck, or a 5½-ton to 6-ton load, exclusive of truck.

The situation resolves itself into this,—that if we are going to permit truck manufacturers and users of trucks to use any size, or carry any load that may suit their convenience or their fancy we shall have a repetition of the struggle between the weight of the rail and the size of the locomotive, a struggle which has been going on for fifty years and is not yet ended, the difference being that the cost of that struggle was paid by the corporation, while the cost of the same struggle between the highway and truck will be paid by the taxpayers. There is still another difference lying in the fact that in the case of the railroads a change of rails usually settled the matter for the time being, while with the case of the highways, not only the wearing surface will be destroyed but the foundation as well, which means the entire pavement. It is obvious to any reasonable person that this situation cannot be permitted on our highways. We cannot permit a pavement paid for by the public, and which is ample to carry 99 per cent of the traffic, to be totally destroyed by a few unreasonably heavy trucks representing a fraction of 1 per cent of the traffic. The solution lies in arriving at the proper beam strength of pavements to meet the weight of the economic load and then through legislation placing the proper limit on weights of loads, and enforcing the law rigorously.

The Bureau of Public Roads at Washington is making some interesting experiments with a view to determining the relative loads that different types and thicknesses of pavement will carry. The State Division of Highways in connection with the U. S. Bureau of Public Roads is conducting some experiments along a different line for the purpose of determining the actual truck loads that pavements of different types and thicknesses will carry.

Cutting Pavements By Compressed Air

Compressed air has been used to a greater or less extent for a number of years past for cutting through street pavements, as has been described in these columns several times. One of the latest installations for this purpose is that of the Western Union Telegraph Company in San Francisco, which uses an outfit for cutting through the pavements of that city for laying wire conduits and pneumatic tubes. This outfit consists of a 6 x 6-inch compressor with a capacity of 65 cubic feet, operated by a 20 h. p. engine. Air is maintained by this equipment at 85 pounds pressure. The whole is mounted on a two-horse wagon with a low-hung frame. Long air hose is used so that it is possible to operate with drills at a considerable distance from the compressor.

The Wanaque Dam

Construction begun on the first structure to be built by the North Jersey District Water Supply Commission. An incentive cost-plus form of contract has been adopted.

The Wanaque Dam, construction of which has just been started in the northern part of New Jersey, is interesting from several points of view. The main dam is about 1,200 feet long and has a maximum height from bed rock to spillway of about 155 feet. The engineering design, while not unique, contains many interesting features, as shown in the description of the dam given in the issue of PUBLIC WORKS for April 17, 1920.

The history of legislation and negotiations connected with the work are also interesting, although especially so, of course, to the communities in the northern part of New Jersey. The main feature in this connection, however, is that this marks the first physical result obtained by the North Jersey District Water Supply Commission, which was created a number of years ago with a view to utilizing, to the best advantage of all the communities, all water supplies in the northern part of the state, and to prevent any private or public corporation from so monopolizing the natural water supplies of the district as to make it impossible for any community to obtain an adequate supply for itself. The state law provides for the co-operation of any number of the cities, towns and small communities in the northern part of the state towards the development of a supply for the common use of all.

The commission selected the Wanaque river as offering the most favorable opportunity for serving the immediate needs of several of these communities. Newark, the largest city in the district, immediately decided to go into the project, but so far none of the other communities has definitely committed itself to it, and after negotiations covering two or three years, Newark finally decided to finance the entire project. The law provides that at any future time other communities may join in by paying their proportionate share of the total cost, and it seems probable and in fact almost inevitable that a number of cities and towns will later co-operate with Newark in the expenses and utilization of the Wanaque supply.

The third feature of interest is the form under which the first section of the work has just been let, this being a form of incentive cost-plus contract. Owing to the present condition of the labor and material market and to certain other considerations, the commission decided to limit the contract awarded this fall mainly to the construction of the core wall, which, in any event, would have to be completed before much work could be done on the main part of the dam. This part of the

construction is about one-quarter of the total in point of cost. It has recently been let to W. H. Gahagan, Inc., of Brooklyn. Mr. Gahagan had representatives on the ground by November 15, and machinery on the way there, and actual construction of preliminary structures has been begun.

The contract allows the contractor 4 per cent commission on the cost up to a certain base price, while if the cost should fall below this price by \$100,000 or less, the contractor will receive in addition 25 per cent of this saving, and if a saving of between \$100,000 and \$200,000 be made, the contractor will receive 50 per cent of such saving. The base price is fixed tentatively at about \$1,125,000, this being the commission's estimate of the cost of the work based on certain estimated quantities and unit prices fixed in connection with assumed labor wage rates. Provision is made for increasing or decreasing this base price in accordance with increases or decreases in prevailing rate of wage, cost of materials, etc. The work was divided into two classes, on one of which the commission fixed a commission of 4 per cent, this consisting chiefly of workmen's quarters, tools, miscellaneous supplies, and other appurtenances of the work which did not form a part of the dam itself, while upon the major part of the work the bidders named the commission for which they would perform the work, and W. H. Gahagan, Inc. named 4 per cent for this part also.

There are numerous minor details regulating the method of calculating the commission due the contractor, but the above gives its broad outlines.

The commission will, of course, have a representative upon the ground to check the time-keeper's accounts and the pay roll, etc. Monthly payments will be made for all materials delivered as well as work done, a percentage of these payments being retained each month until the amount so retained equals \$25,000, after which the full amounts of monthly estimates will be paid. The contractor furnishes a bond in a sum equal to 50 per cent of the estimated contract price.

In our description of April 17, a different form of contract was described, which covered the entire work and required the contractor to give a bond for the full amount of the contract price, etc. No contract was let on these terms on account of the high prices caused by several reasons, one of the determining ones being the uncertain condition of both the material and the labor market, another being the difficulty which contractors found in obtaining bond for \$4,000,000 or \$5,000,000, the estimated cost of the work, consequently the work was subdivided and the method of letting it just described was adopted instead.

The contractor for this first section has been well and favorably known in contract work in this section for twenty years past, and this, combined with the special pains which have been taken to work out the details of the contract just let, leads the commissioners to believe that they will secure satisfactory results with a minimum of cost and a maximum of equity to all concerned.

The work is in charge of Morris R. Sherrerd

as consulting engineer and Arthur H. Pratt as acting chief engineer. Charles E. Gregory, who died in February of this year, was deputy engineer. The North Jersey District Water Supply Commission consists of Laurent J. Tonelle as chairman, Ernest C. Hinck, Wood McKee and Obadiah C. Bogardus.

Wood Preserving Notes By Forest Products Laboratory

That charring does not preserve wood and that water solubility is a necessary property of wood preservatives are conclusions by the laboratory from its experiments.

Charring Does Not Preserve Wood—Charring is of little value in protecting the butts of fence posts and telephone poles from decay. This is shown by service tests made by the U. S. Forest Products Laboratory on fences of charred and untreated posts of various species. The charred posts proved in these tests to be even less durable than the untreated ones.

Theoretically, an area of charred wood around a post should prevent decay, because charcoal does not decay or encourage the growth of fungi. But the charred area around a post is not usually a solid covering. It is checked through in many places. If posts are seasoned before they are charred, the charring does not reach to the bottom of the season checks which are always present. If green unchecked posts are charred, checks will open through the charred part as the wood seasons. In either case the uncharred center of the post is exposed to fungus infection and will decay as rapidly as any untreated wood.

Charring deep enough to resist decay would undoubtedly weaken a post of ordinary size.

Water Solubility a Necessary Property of Wood Preservatives—That any substance, to be an effective wood preservative, must be soluble in water at least to the extent of producing a toxic water solution is the basis of a theory now being developed at the U. S. Forest Products Laboratory. It would seem reasonable to expect that any material which is poisonous enough to kill an organism of any kind must necessarily be soluble in the body fluids of that organism; and the chief body fluid of timber-destroying fungi and wood borers is water. With very poisonous materials this solubility need not be great; in fact, 1 part in 1,000,000 may be sufficient if the material is poisonous enough.

Wood preservatives now in use are of two distinct types—inorganic salts, such as zinc chloride, which are very soluble in water; and oils, such as the creosotes, which are generally considered

to be insoluble. The solubility of creosote is usually considered so slight as to be neglected, but experiments indicate that certain constituents of creosote are sufficiently soluble in water to make it poisonous for wood destroyers. Creosote oil may, therefore, be considered as consisting of two groups of compounds, one of these being sufficiently soluble in water to render it toxic, the other insoluble in water and hence not toxic. The non-toxic oils act as a reservoir for the toxic oils and feed them slowly to the moisture in the wood.

The difference between oil preservatives and inorganic salt preservatives, as far as this theory is concerned, is in their method of retaining the reserve supply of poison. Zinc chloride has no reserve supply, all the material being soluble in the usual amount of moisture present in air-dry wood. Sodium fluoride may have a reserve supply in the form of solid crystals, if applied in a saturated solution. Creosote oil may have a considerable reserve supply stored in the oil itself, this supply being fed to the wood as needed.

Toledo's Street Railways

At the election on November 2, the voters of Toledo, Ohio, approved the granting of a franchise to the Community Traction Co., a newly incorporated company formed to take over the street railway interests of the Toledo Railways & Light Co. The plan thus approved is to result in a lower fare, the 7-cent cash fare, three tickets for 20 cents and 2-cent transfers being reduced to 6 cents, five tickets for 30 cents and 1-cent transfers. After six months the fare will be determined automatically by the size of the stabilizing fund, on the basis of the net income from the first six months' operation on what is known as a service-at-cost system.

A Board of Street Railway Control, consisting of three members, who are neither interested in the company nor employed by the city, is to be appointed by the mayor, and they in turn will choose a street railway commissioner for protecting the rights of the public, whose salary will be paid by the company. This board of control will also prepare plans for more efficient operation and service, being allowed \$1,000,000 for changes and rearrangements in the street railway system.

What may prove to be a valuable supply of road material is being tested on the Warren Nichols farm in Marietta township, near Marshalltown, Ia. The deposit was located last fall by County Engineer H. O. Hickik, and the state highway commission is making borings and tests to ascertain the quantity and quality of the deposit.

The state of South Dakota is expending \$100,000 in building a railroad and improving and developing its coal mine. The coal mine will be fully equipped to furnish coal to all the state institutions of South Dakota.

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CONTENTS

RALPH AVENUE SEWER, BROOKLYN — Illus- trated	527
Amphibious Steam Shovels	531
Blasting with Quicklime	531
WIDTH AND THICKNESS OF ILLINOIS HIGH- WAY PAVEMENTS	532
Cutting Pavements by Compressed Air.....	532
THE WANAKEE DAM	533
WOOD PRESERVING NOTES BY FOREST PRODUCTS LABORATORY	534
Toledo's Street Railways	534
EDITORIAL NOTES	535
Why Good Contractors Sometimes Fail to Bid.— A Desirable Type of Contract.—Minnesota's New Highway Commission	
REPORTS AND RECORDS OF DELAWARE HIGHWAYS	537

Why Good Contractors Sometimes Fail to Bid

Important contracts that are apparently attractive sometimes fail to receive enough bids for satisfactory competition, or the bids are excessively high, or sometimes no bids at all are received. When experienced contractors with good records and sufficient resources fail to make reasonable bids for engineering construction work it is likely to be due to one of several reasons that frequently occur and involve risks that on some occasions the contractors decide to take, or to provide for by excessively high bids. These include:

For the last four or five years the great uncertainty of cost of labor and materials and equipment, the poor quality, unreliability and difficulty of obtaining sufficient labor and the difficulties of transportation and manufacture, which, as relating to construction, have been seriously discriminated against by the Federal government.

Poor advertising; the work may not be advertised over a wide enough field or in mediums reaching the proper readers, especially when a large proportion of the advertising is in local papers; it should always be prominently announced in the technical papers devoted to that class of construction.

Insufficient time may be allowed for the preparation of the contractor's estimate and his investigation of conditions, requirements and probabilities, especially for a large or complicated job or one at a distant point.

Very elaborate work, work involving unusual conditions or work in inaccessible or remote places may require so much expenditure for investigation needed to make a safe bid, that conservative contractors will refuse to bid or will bid excessively high prices to insure themselves against unknown contingencies or assumed conditions.

The specifications may be excessively rigid or they may even be conspicuously unfair, sometimes even being deliberately intended to throw all possible risk and responsibility on the contractor and to deprive him of any opportunity to make even a fair profit.

The contractor may be held responsible for conditions and results entirely beyond his control and which cannot be foreseen. Important contracts written by large cities have even specified that the contractor is responsible for damages incurred through the direct execution of the engineers' specific instruction.

The reputation of the engineer, architect or owner may be one of great rigidity and injustice, even of a disposition to injure the contractor or to litigate with him, or to refuse and delay payment to the utmost. He may have a reputation for unfair dealing or unwarranted interpretation of the specifications or classification of work.

The excessive amount of surety demanded or certified check deposited, or the bonding companies may discriminate against a worthy contractor.

The specifications and even the drawings may be so ambiguous or contradictory that it is impossible to be certain of the requirements.

The contract may contain very undesirable elements impairing an otherwise good job. When these elements are only a small part of the total they can be advantageously separated in an independent contract.

The job may be too small or too large and it may be possible to combine several contracts in one or to separate a large contract into several sections, or to classify the work in it and get separate bids on the different classes.

The contractor may be subjected to adverse political pressure or threatened with payment of blackmail or heavy graft to which he will not submit.

The contractor may have open shop policy in a locality where closed shop labor prevails, and therefore be unable to execute work at that particular place which he would do elsewhere. Some important firms are thus excluded from work in

certain cities where any business they transact must be through subsidiary or allied firms not opposed by the labor union.

The contractor may be inexperienced or unequipped for the special job, a difficulty that is met by adequate and judicious advertising that offers the work to specialists or contractors of wider experience and located in remote places.

All of these reasons appeal much more strongly to upright and experienced contractors than they do to tricky or inexperienced men, so that the latter often bid on contracts and receive work that they are incompetent or unwilling to carry out properly, thus involving the construction in danger and delay with great risk of poor work and liability of extra cost to the owner. If the contractor is honest but unfortunate he may carry the work through and be ruined by it. His place is likely to be filled by a successor either honest or dishonest, thus discouraging the efficient contractor and eventually costing the city more than if the conditions were improved in the first place.

A Desirable Type of Contract

When a construction job is of a standard, simple nature under well-known conditions, and competed for by several satisfactory bidders, the lump sum form of contract is often a very desirable type. If some one of these conditions is lacking, especially if great uncertainties attend the execution of the job, or if it is of a very prolonged or extremely difficult nature, the lump sum form is likely to work hardship to one or the other or perhaps to both parties.

To meet the difficulties and to expedite the work by allowing its commencement without taking time for long and costly preliminary investigations and estimates, and cost-plus type of contract has been devised and used with varying degrees of success, especially in the emergency work of the late war, and since then, to allow for the great variation and uncertainty in the cost, quality and availability of labor and materials. The principal objections to it have been the possibility of increasing the cost of the work and the contractor's fee by unnecessary construction expenses; a lack of incentive for the contractor to reduce the cost of the work; the possibility of undue prolongation of the work, thereby enabling the contractor to unnecessarily employ his organization and equipment that might otherwise be idle; and the uncertainty regarding charges properly covered by the contractor's fee.

Various modifications have been suggested, and some of them applied, to meet these difficulties and to promote the main object of this form of contract which should usually be to place all the necessary cost of the work and unavoidable risk on the owner; to insure a fair remuneration to the contractor for his skill, experience and the use of his organization, resources, plant and equipment; and to effect a just and reasonable participation by both parties in the economies that may be

affected by ingenuity, courage and the efficiency of the construction methods and operations.

One of the most recent and promising examples of this nature is that of the contract recently awarded for preliminary construction work on the great Wanaque dam described in this issue. The work is carefully divided into principal and auxiliary construction, and a fixed percentage is allowed the contractor for the latter and less important part. The contractors were allowed to fix their own percentages in bidding for the main part of the work, which was awarded on a basis of a 4 per cent fee, which happened to coincide with the amount fixed for the other part of the work.

The percentage fee was, however, limited to a certain maximum sum, no matter how great the total cost of the work might prove to be, but on the other hand the fee was increased by a sliding scale bonus increasing with the difference between the actual and the estimated costs of the work if the latter should be reduced beyond certain fixed amounts. Besides these conditions, allowance is made for the increase or decrease of the maximum basis of commission, in proportion to the increase or decrease of fluctuating prices for labor and materials.

These provisions make a very definite basis for the computation of fair and reasonable compensation to the contractor, who finds it to his advantage to execute the work as quickly and economically as is consistent with high-class construction. He is rewarded for efficiency, ingenuity or equipment that may enable him to materially reduce the engineer's estimate of cost, and the owner must in any event pay only for the actual cost of construction and a reasonable fee for superintendence, assuming all the necessary risks, and no more, and thus entirely eliminating the element of speculation.

This arrangement, supplemented by the definite agreement that no doubt exists concerning the amount and character of overhead, superintendence, rental, deterioration, and new equipment charges covered by the percentage or included in the allowed costs, should operate satisfactorily for both parties.

Minnesota's New Highway Commission

At the November election, Minnesota voted in favor of a bond issue of \$75,000,000 for good roads, to be spent by a state highway commission which is to be provided for by a law to be passed by the next legislature. It is stated that the commission will probably consist of five persons appointed for a term of not less than three nor more than five years. Preliminary work of drafting the act for carrying out the decision of the voters has already been begun in the offices of the present state highway commission. The law will probably provide for a graduated motor license fee and state motor law standardizing traffic; the license fees to be so graduated that the gross average will not exceed \$18 a car.

Reports and Records of Delaware Highways

Forms used by State Highway Department of Delaware in obtaining and recording daily reports from engineers and inspectors on the progress of the work, in preparing monthly estimates, etc. Also daily reports of traffic patrol.

The State Highway Department of Delaware is organized, as described last week, into seven main bureaus, each of which maintains complete records and classified information, prepared from reports that cover the activities of the entire force and showing the history and present conditions of every highway.

The Bureau of Economics and the General Office are conducted in accordance with first-class commercial and technical standards adapted to the specific requirements of the character of the department and local conditions, and need not be here described. As the forms and records that have been developed for the other five bureaus represent efficient engineering for public work, some of the principal features are here presented.

SURVEYS

Surveys of old and new roads, locations, realignments, lines, levels and measurements of cut and fill are made by survey parties, usually consisting of the instrument man, recorder and two assistants, who occupy temporary quarters in the vicinity of important work or are transported back and forth, night and morning, by public conveyance or in default of that, by the department's service automobiles. The leader of the party sends to headquarters a daily report made out on an 8 x 5½-inch Daily Survey Report blank with printed heads for title, date, weather, temperature, began work, stopped work for A. M. and P. M., chief of party, address, contract, survey, route, between..... and..... office, field. Separate lines are headed Base Line..... Sta..... Sections or Profile..... Sta..... to Sta. Check Levels..... Sta..... to Sta. Names of men in party. Requisitions Issued, and Remarks.

DESIGN

From the surveys and other data the line is located, roadway and structures designed, quantities computed, bills of materials made, contracts and specifications prepared, and invitations issued to bidders. For each contract there is printed an official **Detail Estimate Sheet** 25½ inches wide and 11 inches long, headed Contract No.....

from..... to..... Sta..... to Sta....., Period Ending..... 19.... Contractors. It is on heavy yellow paper, ruled in 40 main vertical columns with 10 wide horizontal lines below the headings. The first column is headed Station to Station, and the next 29 columns are successively headed: Clearing and Grubbing, Acres; Clearing, Acres; Excavation, Cu. Yds.; Borrow, Cu. Yds.; Rock Excavation, Cu. Yds.; Concrete Masonry "A," Cu. Yds.; Concrete Masonry "B," Cu. Yds.; Concrete Masonry "C," Cu. Yds.; Steel Reinforcement, Pounds; Steel Reinforcement, Sq. Ft.; Pipe, Lin. Ft.; Pipe, Lin. Ft.; Pipe, Lin. Ft.; Relaid Pipe, 18 in. and under, Lin. Ft.; Relaid Pipe Over 18 in., Lin. Ft.; Underdrain, Lin. Ft.; Gutter, Sq. Yds.; Concrete Curb, Lin. Ft.; Bounds, No.; Piles, Lin. Ft.; Wood Guard Rail, Lin. Ft.; Concrete Foundation for Roadway, Cu. Yds., Stone for Macadam, Tons; Slag for Macadam, Tons; Cement Concrete Roadway, Cu. Yds.; Joints Do., No.; Vitrified Brick Pavement, Sq. Yds.; Hillside Vitrified Brick Pavement, Sq. Yds. The 10 remaining columns are left blank for any required special headings to be written in.

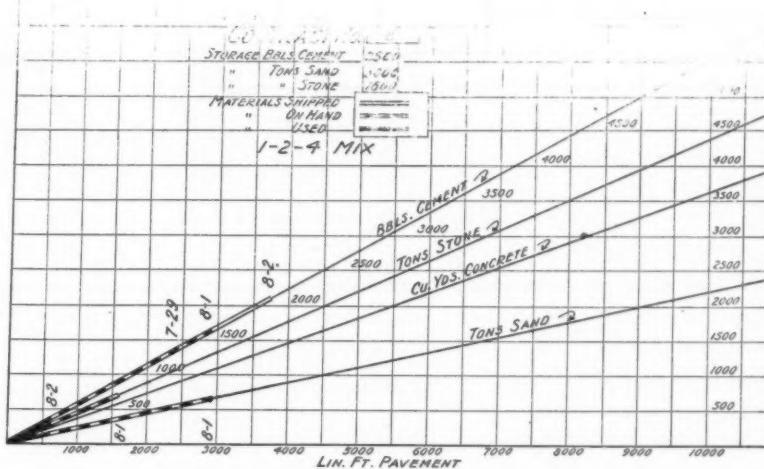


Fig. 1. DIAGRAM SHOWING, BY INSPECTION, POSITION OF ROAD MATERIALS

In each main vertical column from 2 to 5 faint vertical lines are ruled to separate the figures. Between each pair of heavy horizontal lines the wide space is divided by four faint horizontal lines, thus allowing for five items for each section. At the foot of the sheet the last three lines are headed, Total to Date, Previous Estimate, and This Estimate.

CONSTRUCTION

For the work under contract, state materials are reported on arrival by postal card blanks mailed immediately to headquarters. They are entitled **Daily Report of Materials Received** and are printed thus: "The following shipments of materials have been received for use on Contract No.....1920. Car initials and number. Quantity. Kind and brand of material. Signed....."

In order to secure government freight allowances there was, during the period of Federal control of the railroads, a separate exemption certificate filed for each consignment, a practice that has been discontinued since the return of railroads to their owners.

The amounts of materials shipped, on hand, and used for each contract are marked off on line plot-

ted on a diagram entitled **Material Chart**, which is kept posted up to date and instantly shows by inspection just how the supply stands. The lines here shown for convenience by conventions are, on the office diagram, marked in colors, blue for shipped, yellow for on hand, and red for used.

Each inspector on each contract reports daily on an 8½ x 11-inch blank printed as here shown. The upper part, 6½ inches long, has, under the headings, 15 lines for records and one line for totals, below which there is a perforated line for detaching the Material and Construction Report 4½ inches long. (See Fig. 2.)

The engineer's report is made on both sides of an 8½ x 11-inch blank. One side is headed: For week ending.....19..... Contractor..... Resident Engineer, from..... to miles.

THE STATE OF DELAWARE

STATE HIGHWAY DEPARTMENT

Inspector's Daily Report

CONTRACT NO.

Temp. { Max.
Min.

Weather 192

LOCATION AND PROGRESS OF WORK		Sta.										
COST RECORD		Sta.	Grading Earth	Grading Rock	Roadside Guard Rail Etc.	Pipe Culverts	Ditches and Drains	Concrete Masonry	Concrete Roadway	Brick Surface		
Classification	No.	Rate	Hrs.	Total								
TOTALS												

DIVISION OF TESTS AND INVESTIGATIONS

Material and Construction Report

Contract No. 192

ROADWAY MASONRY

Kind of brick used	
Kind of slag or stone used	
Kind of sand used	
Brand of cement and number of bags used	
Kind and percentage of hydrated lime used	
Source of water supply	
Kind and location of joints	
Kind and condition of material in subgrade	
Number and location of cracks in previous day's work	
Amount of concrete laid today	ft. in cut
From Sta.	to Sta.
Number of test specimens made	at Sta.
Remarks:	and buried at Sta.
	Signed.....

Fig. 2. INSPECTOR'S DAILY REPORT

Progress Week Ending..... The space below the heading is ruled for totals on top line, under which there are 14 wide horizontal spaces, each ruled with 3 intermediate lines, making 4 narrow spaces in each set, which are respectively marked at the left, 75 per cent, 50 per cent, 25 per cent, 0. Opposite the printed items, Clearing and Grubbing, Rough Grading, Fine Grading, Concrete Masonry, Concrete Roadway, Concrete Foundation, Vitrified Brick Surface, Surface. Four following lines are left blank for special headings to be written in and are followed by lines headed Completed Highway and Total Contract. On the op-

posite side of the sheet a table for detail records of work is printed and is followed by 8 lines for the names and titles of engineering force. (See Fig. 3.)

Each member of the engineer field force is required to make a daily report on a blank printed on a postal card. (See Fig. 4.)

Monthly estimates for current payments are made out on 11 x 16½-inch blanks ruled below. (See Fig. 5.) In the column of Contract Items the lines are headed:

Squares Clearing, Squares Grubbing, Squares Stripping.

THE STATE OF DELAWARE STATE HIGHWAY DEPARTMENT ESTIMATE								
From	To							Contract No. Estimate No.
Sta.	to Sta.							Contractor
Date from to								
Quantities This Estimate	Quantities Previous Estimate	Total Quantities To Date	CONTRACT ITEMS	Contract Prices	Total Amount To Date	Amount Previous Estimate	Amount This Estimate	Remarks
Total Contract Items								
MATERIALS								
		Bbls. Cement						
		Tons Sand						
		Tons Stone						
Total Materials								
EXTRA WORK								
Previous Estimates: Order No.								
This Estimate: Order No.								
				Total Extra Work				
Total Estimate to Date								
10 Per Cent Reserved								
Previous Payments								
Total Deductions								
AMOUNT OF THIS ESTIMATE								

Made by
 Checked by
 Checked by
 Audited by

This Estimate approved Date
 for \$ Date
 Chief Engineer
 Chairman

Fig. 5. MONTHLY ESTIMATE SHEET

- Cu. Yds. Excavation, Cu. Yds. Borrow, Cu. Yds. Screening.
- Base Course—Cu. Yds. Cement Concrete Pavement, Sq. Yds. Surface Course.
- Tons Waterbound Macadam, Cu. Yds. Cement Concrete Class A, Cu. Yds. Cement Concrete Class B.
- Lbs. Steel Reinforcement, Lbs. Plain Structural Steel, Catch Basins, Drop Inlets, Manholes.
- Lin. Ft. Inch Pipe Culvert, Lin. Ft. Inch Pipe Culvert, Lin. Ft. Inch Pipe Culvert.
- Lin. Ft. Inch Pipe Culvert, Lin. Ft. Relaid Pipe, Lin. Ft. Tile Underdrain.
- Sq. Yds. Gutter, Lin. Ft. Curb, Lin. Ft. Wood Guard Rail.
- Monuments, Lin. Ft. Piling.
- The department maintains a motor cycle traffic police patrol of about one officer to every 10 miles of the most heavily traveled improved roads, the present total number of patrolmen being about 20. Each officer reports daily to headquarters on a form printed on a postal card. (See Fig. 6.)

CONTRACT NO.

RESIDENT ENGINEER'S WEEKLY REPORT

For Week Ending 19..

CONTRACTOR'S FORCE	DAILY	WORK DONE DURING WEEK	
Average No. of Men	Clearing	Sta.	to Sta.
Average No. of Teams	Rough Grading	Sta.	to Sta.
Average No. of Trucks	Fine Grading	Sta.	to Sta.
Rollers	Concrete Roadway laid	Sta.	to Sta.
Mixers	Concrete Foundation laid	Sta.	to Sta.
Graders	Vitri. Brick Surface laid	Sta.	to Sta.
Steam Shovels	Surface laid	Sta.	to Sta.
	Pipe laid at	Stas.	
	Culverts under Construction	at Stas.	
	Culverts Completed	at Stas.	
	Bridges under Construction	at Stas.	
	Bridges Completed	Stas.	
	Completed Highway	Sta.	to Sta.

REMARKS:

MEASURING BOXES CHECKED

SCREED (CROWN) CHECKED

Fig. 3. RESIDENT ENGINEER'S WEEKLY REPORT

STATE HIGHWAY DEPARTMENT		Station	Mileage
EMPLOYEE'S DAILY REPORT		.....	Gals. Gas
To Be Made Out and Sent to Dover Every Night		.....	Qts. Oil
Name	Date .....	.....	.....
Address .....		.....	.....
Arrived at work	Left Work .....	.....	.....
Contract No. Sta.	to Sta. ....	.....	.....
Time away from work	If absent while work is in progress give length of time and reasons .....	.....	.....
Worked today .....	.....	.....	.....
With (name other employees) .....	.....	.....	.....
Other Information .....	.....	.....	.....
		Accidents: License Nos. .....	.....
		Damage to Cars .....	.....
		Personal Injuries .....	.....
Special letter report to be made out of accidents where serious injuries are involved caused by fast and reckless driving			

Fig. 4. EMPLOYEE'S DAILY REPORT

Fig. 6. MOTORCYCLE OFFICER'S DAILY REPORT

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

CATERPILLAR WINCH

The Holt Manufacturing Company has devoted several years to the production of a satisfactory auxiliary winding drum or winch attachment for a tractor. Investigations having convinced them that none of the commercial winch attachments were adequate, the Holt engineers, after several years of endeavor and strenuous field tests, have perfected the winch now placed on the market so that it does not affect the traction ability of the tractor, but increases its operating range.

Power is taken from the transmission plates in the rear and carried to the winch through a gear train and propeller shaft with final miter gears and internal gear type of planetary.

The drum is 8 inches in diameter and 13 inches long with a capacity for 1,300 feet of $\frac{1}{2}$ -inch cable or 590 feet of $\frac{3}{4}$ -inch cable. With a pull of 10,400 pounds it has a speed of 108 feet per minute and reverse speed of 583 feet. With a pull of 4,450 pounds it has a speed of 252 feet or reverse of 1,360 feet. With a pull of 5,840 pounds it has a direct speed of 192 feet and reverse speed of 1,036 feet, and with a pull of 2,485 pounds it has the high speed of 454 feet direct and 2,150 feet reverse. The clutch is of ample size to permit slipping and to secure any speed up to maximum. All moving parts except the winding drum are completely enclosed, insuring protection for the operator. The above specifications apply to the 5-ton Caterpillar tractor, special specifications being provided for the winch on the 10-ton Caterpillar tractor.

Skidding logs out of steep hollows or other inaccessible places is easily accomplished with the winch and then the "Caterpillar" is available to skid the trail down the mountain or pull the loaded wagons to the railroad or mill.

In the oil fields it combines the "caterpillar's" service as a cross-country locomotive, that hauls the boilers, casings and supplies to the location with the ability to pull and run back rods, tubing, etc.

The winch is especially adapted to well-driving service.

WHITE POWER DUMPING TRUCK

The Model 45-D 5-ton power dumping truck built by the White Company provides a reliable and durable mechanism for rapidly dumping loose material. Power from the transmission operates a protected screw and nut device controlled by a hand lever at the driver's seat. By this device the truck body can be raised and held at any angle up to 45 degrees, while the truck remains stationary or is driven backwards or forwards. Releases, operating at both ends of the screw shaft, automatically cut off the power when the body reaches an ex-

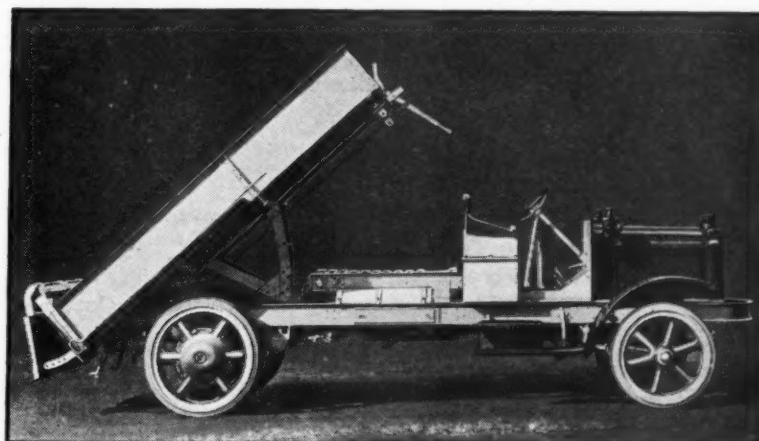


TRACTOR WINCH WITH PULL OF 10,400 POUNDS AT SPEED OF 108 FEET PER MINUTE

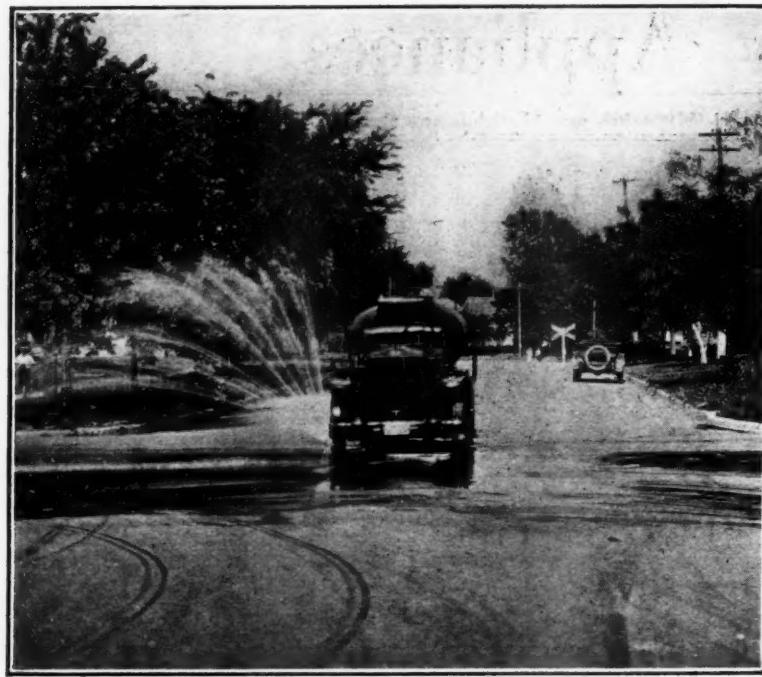
treme elevation or returns to its normal position.

The dump body is a heavy reinforced steel construction with a swinging tail board, pivoted at the top that

can be set for any given discharge, enabling sand, gravel or other materials to be dumped and automatically spread to a uniform required depth while the truck moves forward or back.



POWER DUMP OPERATED FROM DRIVER'S SEAT BY SCREW AND SHAFT PROTECTED MECHANISM



STREET SPRINKLER MOUNTED ON AUTOMOBILE TRUCK

WHITE TRUCK SPRINKLERS

In Oklahoma City and Tulsa, Okla., the streets are flushed by a sprinkler tank mounted on a White automobile truck chassis. When operating on street-car tracks, the dirt is washed out from between the rails by a pair of forward nozzles, after which the jets

from the rear nozzles wash it across the street to the gutters.

When there are no tracks in the street, the jets, under 6 pounds pressure, can sprinkle the full width of a wide street and when full pressure is applied, water can be thrown well beyond the curbs on both sides of a 40-foot street.

PERSONALS

McDermott, J. R., has resigned as Assistant Highway Engineer of Harrison county, Ohio, to accept a position with the West Virginia Road Commission as Assistant Division Engineer, with headquarters at Keyser, W. Va.

Wheeler, Frederick S., formerly Resident Engineer of the California State Highway Commission, is now associated with the Efficiency Engineer, Producing Department, Standard Oil Co., Delano, Cal.

Powell, O. N., Dallas, Texas, has been appointed Engineer of Nueces County, Texas, to succeed H. A. Stevens, who recently resigned.

Edwards, John T., has recently been appointed Supervisor of Maintenance in the New Jersey State Highway Department.

Davis, J. C., who was formerly connected with the University of Oklahoma, has been appointed Testing Engineer for the Oklahoma Highway Department.

Snead, Charles D., is now Senior Highway Bridge Engineer, U. S. Bureau of Public Roads, to succeed J. L. Parker, of the Montgomery, Ala., District.

Whitecarver, O. W., who for twenty years was Assistant Engineer of Georgetown, S. C., has been appointed Assistant Engineer with the Charleston, S. C., office of the U. S. Bureau of Public Roads.

Parker, J. L., formerly Senior Highway Engineer in the oMntgomery, Ala., District of the U. S. Bureau of Public Roads, is now Special Bridge Engineer with the South Carolina State Highway Commission.

Allen, James P., and Fitzsimmons, W. S., formerly assistant engineers in the Charleston, S. C., office of the U. S. Bureau of Public Roads, are now engaged in private engineering practice.

Butler, Drury, Surveyor, Sacramento County, Cal., has been appointed County Engineer.

Bennett, M. O., Division Engineer of the Oregon State Highway Department, Pendleton, Ore., has resigned to take up farming at Lewistown, Mont.

Carman, Edwin S., of Cleveland, Ohio, in a mail ballot of the American Society of Mechanical Engineers was elected president of that society, to succeed Major Fred J. Miller.

Winslow, Col. C. Eleleth, who has been Pacific Division Engineer and District Engineer of the First San Francisco District, Corps of Engineers, U. S. A., has been transferred to New York as Corps Area engineer of the Second Corps Area.

Macdonald, K. S., has resigned as town engineer of Barrie, Ont., in order to accept a position with the Hydro-Electric Power Commission at Paris, Ont.

Shaw, A. W., has resigned as water works superintendent of Brandon, Man., after twenty years' service in that department.

Foreman, A. E., of Victoria, B. C., has resigned as chief engineer of the British Columbia Department of Public Works in order to join a business organization in Vancouver.

Theriault, L. L., has resigned as town manager of Edmundson, N. B., and has resumed his former position as division engineer on the staff of the New Brunswick Department of Public Works, under B. M. Hill, chief engineer of highways.

Hogg, T. H., deputy chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, and J. J. Traill, assistant hydraulic engineer of the same commission, have been appointed members of the Senate, University of Toronto, to represent the Faculty of Applied Science and Engineering. Dr. George G. Nassmith, consulting engineer, Toronto, has been elected to a similar position to represent University College.

Moore, H. J., who was formerly connected with the Queen Victoria Niagara Park Commission in the capacity of highway forester, is now filling a similar position with the Ontario Highways Department.

Chace, W. G., and Fellowes, Lyon F., have been appointed as consulting engineers to the Saskatchewan Water Commission.

Reaburn, D. L., formerly superintendent of Mount Rainier National Park, has been appointed superintendent of the Grand Canyon National Park.

Nyman, Carl, formerly resident engineer, State Road Commission, Utah, has resigned to enter private practice in general engineering in the coal fields of Carbon County, Utah, with headquarters at Castlegate.

Clements, V. H., has taken a position as assistant engineer in the office of the Irrigation Engineer, Bureau of Public Roads and Rural Engineering, U. S. Department of Agriculture, San Antonio, Texas.

Muth, Frank, Manitowoc, Wis., has resigned as highway commissioner of Manitowoc County to engage in highway and bridge contracting.

Markwart, A. H., a member of the firm of Galloway & Markwart, consulting engineers, San Francisco, has been appointed director of engineering with the Pacific Gas & Electric Co., San Francisco, and will have supervision over the organization's hydraulic, production, transmission and distribution engineers, and also have production, transmission and distribution engineers, and also have charge of designs on all company plants and equipment.

Haasler, John J., formerly office engineer, Nueces County Highway, Texas, has accepted a position as field engineer with the Power Department of San Antonio, Texas.

Johnson, J. G., formerly with the Milwaukee Gas Light Co., and engineering inspector of the Milwaukee Sewerage Commission, has been engaged as city engineer and superintendent of water works, Milwaukee, Wis.